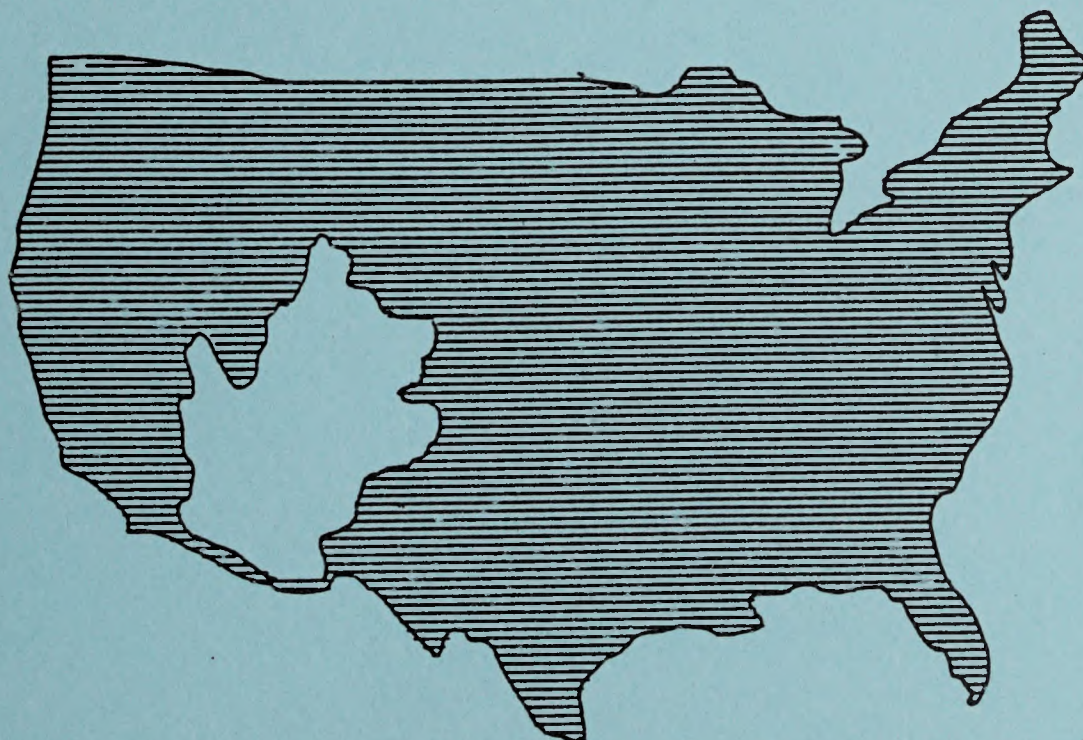




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1989 Joint Evaluation of Salinity Control Programs in the Colorado River Basin

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1989 Joint Evaluation of Salinity Control Programs in the Colorado River Basin

December 1989

Prepared by the
Bureau of Reclamation
U. S. Department of the Interior

and the
U.S. Department of Agriculture

in cooperation with the
Bureau of Land Management,
Geological Survey, Fish and Wildlife Service,
and the Environmental Protection Agency

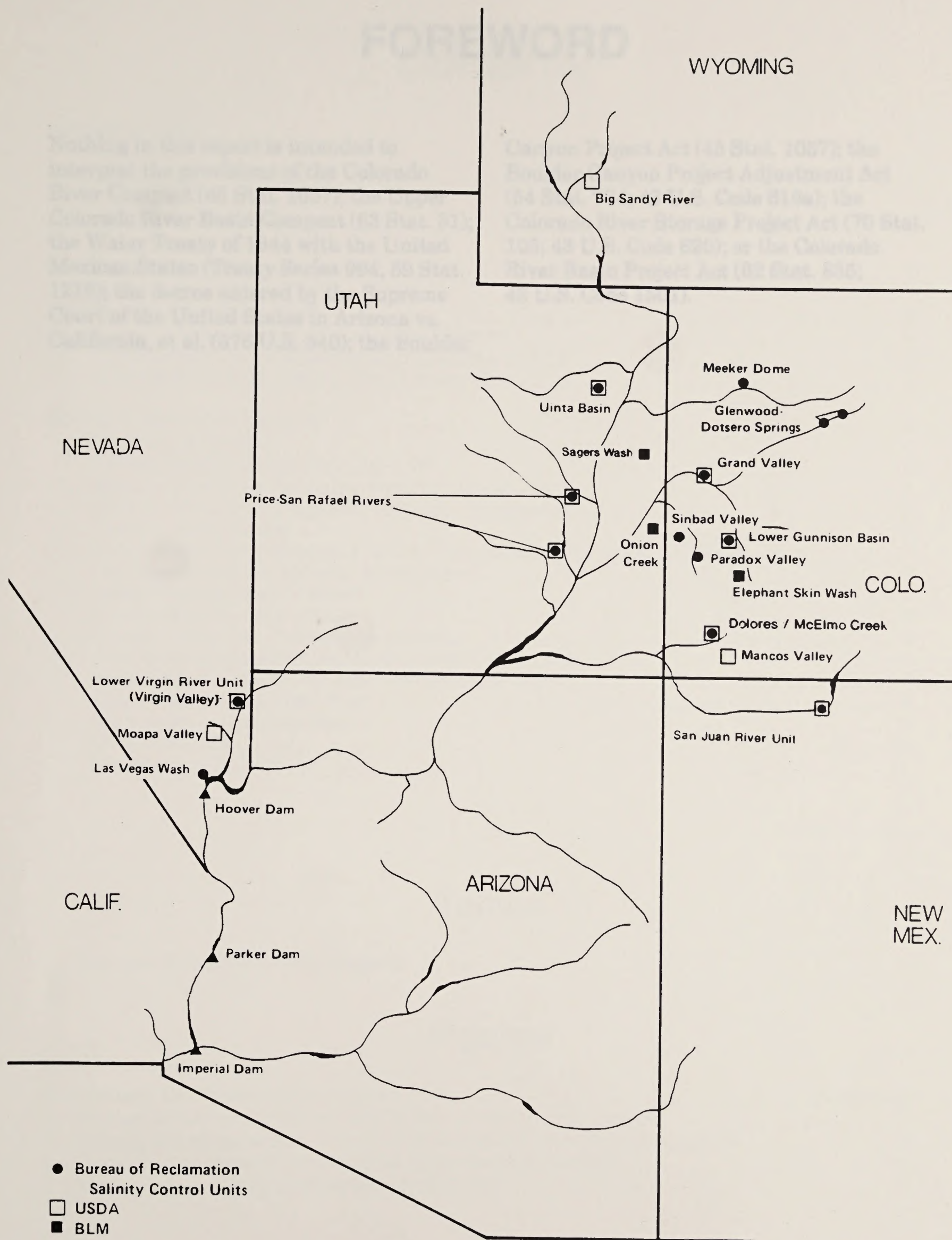


Figure 1.—Colorado River Basin Salinity Program.

FOREWORD

Nothing in this report is intended to interpret the provisions of the Colorado River Compact (45 Stat. 1057); the Upper Colorado River Basin Compact (63 Stat. 31); the Water Treaty of 1944 with the United Mexican States (Treaty Series 994, 59 Stat. 1219); the decree entered by the Supreme Court of the United States in Arizona vs. California, et al. (376 U.S. 340); the Boulder

Canyon Project Act (45 Stat. 1057); the Boulder Canyon Project Adjustment Act (54 Stat. 774; 43 U.S. Code 618a); the Colorado River Storage Project Act (70 Stat. 105; 43 U.S. Code 620); or the Colorado River Basin Project Act (82 Stat. 885; 43 U.S. Code 1501).

Colorado River Basin Salinity Control Program (Forum)	3
PROJECT AND UNIT STATUS	4
Big Sandy, Wyoming	4
Colorado/McInnis Creek Unit, Colorado	4
Elephant Butte Wash Verification Project, Colorado - BLM	5
Glenwood-Terrell Springs Unit, Colorado - Reclamation	5
Grand Valley, Colorado	5
Grand Valley Desert Watershed Activity Plan Demonstration Project, Colorado - BLM	7
Las Vegas Wash Unit, Nevada - Reclamation	7
Lower Canadian River, Colorado	7
Mojave Valley, Nevada - USDA	8
Parkman Valley Unit, Colorado - Reclamation	9
Parkman Draw Riparian Demonstration Project, Utah - BLM	9
Purple-Sea Island River Unit, Utah - Reclamation/USDA	9
Sagehen Wash Project, Utah - BLM	9
San Juan River Unit, New Mexico	10
Utah Basin, Utah	10
Monitoring and Evaluation	11

Tables

1. Colorado River Basin Salinity Program	13
--	----

Figures

1. Colorado River Basin Salinity Program	Frontispiece
2. Average salinity projections at Imperial Dam without further controls	12
3. Average salinity projections at Imperial Dam with and without further controls	12
4. Colorado River Basin Salinity Program implementation schedule	14
5. Actual average salinity conditions at Imperial Dam	15

Contents

INTRODUCTION	1
BACKGROUND	1
FINDINGS	2
RECOMMENDATIONS	2
PROGRAM COORDINATION	3
Technical Policy Coordinating Committee (TPCC)	3
USDA Salinity Control Coordinating Committee (SCCC)	3
Colorado River Basin Salinity Control Forum (Forum)	3
PROJECT AND UNIT STATUS	4
Big Sandy, Wyoming	4
Dolores/McElmo Creek Unit, Colorado	4
Elephant Skin Wash Verification Project, Colorado - BLM	5
Glenwood-Dotsero Springs Unit, Colorado - Reclamation	5
Grand Valley, Colorado	5
Grand Valley Desert Watershed Activity Plan Demonstration Project, Colorado - BLM	7
Las Vegas Wash Unit, Nevada - Reclamation	7
Lower Gunnison Basin, Colorado	7
Moapa Valley, Nevada - USDA	8
Paradox Valley Unit, Colorado - Reclamation	9
Pariette Draw Riparian Demonstration Project, Utah - BLM	9
Price-San Rafael Rivers Unit, Utah - Reclamation/USDA	9
Sagers Wash Project, Utah - BLM	9
San Juan River Unit, New Mexico	10
Uinta Basin, Utah	10
Monitoring and Evaluation	11

Tables

1 Colorado River Basin Salinity Program.	13
---	----

Figures

1 Colorado River Basin Salinity Program ..	frontispiece
2 Average salinity projections at Imperial Dam without further controls	12
3 Average salinity projections at Imperial Dam with and without further controls	12
4 Colorado River Basin Salinity Program implementation schedule	14
5 Recent average salinity conditions at Imperial Dam	15

1989 Evaluation of Salinity Control Programs in the Colorado River Basin

Introduction

This summary report is a combined Department of the Interior and Department of Agriculture effort to fully coordinate and integrate the respective salinity control programs authorized in Public Law 98-569, amendments to the Colorado River Basin Salinity Control Act of 1974 (Public Law 93-320). Programs needed to achieve the objectives of Public Law 93-320 and Public Law 98-569 are shown in figure 1. The report describes major program activities through fiscal year 1989.

The Quality of Water Colorado River Basin, Progress Report No. 14 contains a more complete summary of agency and unit activities. Progress Report No. 14, prepared by the Upper Colorado Region of the Bureau of Reclamation has been distributed and covers many water quality parameters. Limited copies may be obtained by writing the Regional Director, Upper Colorado Region, Bureau of Reclamation, P.O. Box 11568, Salt Lake City, Utah 84147.

Background

The 1989 evaluation was prepared by updating the 1988 evaluation report because no changes have been made in the recommended plan. The 1988 evaluation used January 1988 prices and adjusted data to more accurately compare the program information of the Department of the

Interior (DOI) and the Department of Agriculture (USDA), and interest or discount rates (8-5/8 percent) are at the same base. (See 1988 Joint Evaluation Report appendix.) Repayment analysis for the Lower Colorado River Basin Development Fund are based on the 1988 rate of 9-3/8 percent interest for the years 1988 and beyond.

The CRSS (Colorado River Simulation System) computer model analysis is unchanged from the 1988 analysis and no changes have been made in the depletion projections developed jointly by Reclamation and the Colorado River Basin Salinity Control Forum (Forum).

The salinity at Imperial Dam, without further controls, is projected to reach an average total dissolved solids (TDS) of 970 mg/L by the year 2010. Figure 2 provides a historical perspective in addition to the numeric standard and the projections at Imperial Dam. It is readily apparent that without the recommended controls, the salinity at Imperial Dam is expected to increase significantly due to projected normal or below normal hydrologic conditions. Using the salinity projections at Imperial Dam, salt load reductions required to maintain an average TDS level at or below the numeric criteria of 879 mg/L are estimated to be slightly in excess of 1 million tons per year by the year 2010 and are referred to as the program objective. Figure 3 shows how the implementation plan meets the numeric criteria.

Findings

The recommended plan is expected to satisfy salt load reduction objectives and program goals by maintaining average TDS at Imperial Dam, below Parker Dam, and below Hoover Dam at or below 879, 747, and 723 mg/L, respectively, using a mean water supply of 15,000,000 acre-feet per year (average of 15 hydrologic traces). The recommended plan's implementation schedule is shown on table 1 and figure 4.

The analysis was based on January 1988 data. An annual review is required to check progress against program objectives and to review and evaluate any newly developed data. As evidenced by past program activities, long lead times are required for project planning and implementation, and construction costs will continue to increase. To minimize program costs and to avoid increased inflation expenses, program planning, implementation schedules, and funding levels should be consistent with the recommended plan. Although high flows had temporarily lowered salinity levels in the system, construction should not be delayed. Salinity levels are currently rising, as evidenced by figure 5, and any delay would affect program continuity and increase overall program costs.

- The recommended plan will satisfy the remaining salt load reduction objective of removing slightly over 1 million tons per year by 2010 and the program goal of maintaining average TDS at or below 879 mg/L at Imperial Dam based on long-term mean water supply.
- Implementation of the recommended plan is predicated on receiving adequate annual funding.
- In order to meet the program objectives and goals beyond the next decade and to maintain program continuity, construction

of several new units needs to be initiated in the next few years.

- To meet the program salt load reduction objectives, it is necessary to have a mix of both USDA and Interior projects.
- Repayment analysis of the Lower Colorado River Basin Fund prepared for the 1988 Evaluation Plan showed that sufficient funds are available to cover all costs (capital, O&M, interest, and inflation) of the recommended plan. There have been no changes during 1989 which would alter the repayment analysis.
- Continued close Federal and State coordination among Interior, USDA, the Interagency Salinity Control Coordinating Committee, the Forum, and the Colorado River Basin Salinity Control Advisory Council (Advisory Council) is critical for effective management of the program.
- To keep the project implementation schedule on track and to allow for inclusion of newly formulated, more cost-effective units and changes in technology, this evaluation will be updated annually.

Recommendations

- The Basin States are actively supporting implementation. Under the USDA program, the States have devoted considerable time to assisting with resolution of a variety of issues. Within each of the USDA projects, State agencies are participating in program implementation. In Nevada, the State has appropriated matching funds for installing phase I of the Moapa Valley salinity control program.
- DOI and USDA should support the investment level required for the current implementation plan for program planning and budgeting.

- All involved agencies should continue to work toward full implementation of the USDA Colorado River Salinity Control Program in coordination with DOI.
- Reclamation should continue to refine the procedures to estimate the salt load reduction objectives for future program analysis.
- Involved agencies should continue analyses of project construction schedules for possible modifications to allow other cost-effective projects to be started earlier or inserted into the program as new data are made available.
- Reclamation and USDA should continue program evaluation annually to monitor progress and to improve on investment and repayment analysis.

Program Coordination

Program coordination between USDA and Reclamation is occurring by agency interaction at the field level and through the USDA and Reclamation salinity control coordinator positions in Denver.

Technical Policy Coordinating Committee (TPCC)

Technical coordination between Reclamation and SCS is accomplished through the Technical Policy Coordinating Committee (TPCC). In recent years representatives from the Fish and Wildlife Service, Geological Survey, Bureau of Land Management, Environmental Protection Agency, and the Forum have participated in TPCC meetings. During 1989 the full committee met once and subgroups of the committee met several times to address specific issues. Among these issues were resolution of the Price-San Rafael water and salt budgets and environmental concerns in

several salinity projects. Because policy issues were being brought before the TPCC, the TPCC recommended that the Interagency Salinity Control Coordinating Committee be reinstated to address Federal Interagency policy issues.

USDA Salinity Control Coordinating Committee (SCCC)

The USDA Salinity Control Coordinating Committee is responsible for the coordination of USDA program activities at the national level. This committee is comprised of representation from the Agricultural Stabilization and Conservation Service (ASCS), Extension Service (ES), and the Soil Conservation Service (SCS). Unofficial members represent the Bureau of Reclamation, Environmental Protection Agency, and the Bureau of Land Management.

This committee met regularly and took action on various program policies, procedures, and fund management issues. The committee reviewed all Project Implementation Plans and also made program implementation recommendations for effective agency coordination. The committee held their August 1989 meeting at Delta, Colorado, and toured the Lower Gunnison (Tongue Creek) salinity control unit.

Colorado River Basin Salinity Control Forum (Forum)

The Colorado River Basin Salinity Control Forum was established in 1973 as a mechanism for interstate cooperation and to develop water quality standards. The Forum is composed of up to three water resource or water quality representatives from each of the seven Colorado River Basin States.

Project and Unit Status

Big Sandy, Wyoming

Reclamation

The *Planning Report Concluding the Study* was published for Reclamation's Big Sandy River Unit in March 1989. The study was concluded because no cost-effective plan could be formulated.

USDA

This was the second year of funding for salinity control contracts in the Big Sandy Project. To date, seven salinity control contracts have been signed with participants obligating a total of \$427,000. In 1989, participants installed four sprinkler irrigation systems on 411 acres for salinity control and SCS is providing technical assistance to each participant on irrigation management. As of October 1, 1989, approximately 22 CRSC applications are on file in the USDA office.

Agricultural Stabilization and Conservation Service (ASCS) opened a county suboffice in the Farson, Wyoming, USDA Office early in the fiscal year to more efficiently service program participants. The Cooperative Extension Service (CES) has also located an Extension Agent in the USDA office to carry out full-time information and education programs for salinity control.

An SCS wildlife biologist is located in the Farson USDA office and provides full-time assistance for planning, installation, and tracking of wildlife habitat.

Dolores/McElmo Creek Unit, Colorado

Reclamation

The Final Supplement to the Final Environmental Statement was completed, approved, and filed March 24, 1989. The construction contract for Reach 1 of the Towaoc Canal was awarded and work began in the fall of 1989. The design for Reach 2 has been prepared. A construction contract award is scheduled for April 1990. The design for Reach 3 and the lateral system on the Ute Mountain Ute lands are complete and awaiting selection of the design contractor. The design for the Rocky Ford Laterals will be submitted in January 1990 with award scheduled for September 1991. The design package for lining the Upper Hermana Lateral and the Lone Pine Lateral will be submitted in December 1991 with award scheduled for September 1992.

Coordination continues with the Soil Conservation Service, the Montezuma Valley Irrigation Company, and the Dolores Water Conservancy District.

USDA

The final USDA McElmo Creek Environmental Impact Statement (EIS) was published in August 1989. The Record of Decision was issued on October 2, 1989. With these actions completed, USDA will allocate cost-share funds for salinity control contracts to this project in fiscal year 1990 and begin implementation. SCS has staff located in the Cortez Field Office who have been providing technical assistance to individuals and groups for pre-implementation activities. This includes coordination of the planned onfarm salinity control actions with the Bureau of Reclamation canal and lateral construction program.

The USDA program provides for the installation of 19,700 acres of sprinkler irrigation systems and 268 miles of irrigation pipeline and 1,850 acres of improved surface systems. The USDA program is projected to reduce salt loading to the Colorado River by 38,000 tons per year. Replacement of wildlife habitat values foregone during implementation will be carried out in accordance with the procedures identified in the EIS. An experienced wildlife biologist was assigned to the Cortez SCS field office in November 1989. This biologist will provide leadership for implementation of the voluntary wildlife habitat replacement program.

The Cooperative Extension Service developed an information brochure which describes the McElmo Creek salinity program. A slide/tape presentation on the salinity program is in the process of being finalized.

Elephant Skin Wash Verification Project, Colorado - BLM

The Elephant Skin Wash Verification Project was implemented in 1984 and established to determine the effectiveness of controlling natural erosion through the implementation of structural measures only. The decision made in the Uncompahgre Resource Management Plan concerning this project was to maintain existing structures and to conduct detailed monitoring. A monitoring evaluation report addressing the effectiveness of this project is scheduled for 1992.

Glenwood-Dotsero Springs Unit, Colorado - Reclamation

Reclamation is pursuing an evaluation of a potential industrial use alternative for this unit. The potential development would

include the use of waste heat from a natural gas turbine power plant to desalinate a portion of the saline springs water in Glenwood Springs, Colorado. The byproduct salt could be marketed by the developer to replace salt which is imported into the Colorado River Basin. The desalinated water would either be returned to the Colorado River or marketed to some local users. Reclamation has completed a competitive negotiated cooperative agreement for the planning, construction, and operation of the facility with the developer.

The process would prevent approximately 65,000 tons of salt per year from entering the Colorado River. The cooperative agreement was signed in the fall of 1989. In fiscal year 1990, Reclamation and the developer will cooperate to prepare an environmental assessment and the necessary documents to seek authorization of the project from Congress. Public involvement and information activities began early in October with duties shared by both entities.

Grand Valley, Colorado

Reclamation

Reclamation's canal lining of the west end Government Highline Canal was completed with an additional 5,600 tons of salt precluded from entering the river system annually. Seventeen miles of laterals were placed in pipe; this work was substantially complete by May 1989. A contract to pipe another 15 miles of laterals was let this fall. When completed, these lateral improvements will reduce salinity by 20,000 tons per year.

More than \$12,000 was paid to Grand Valley Irrigation Company (GVIC) for salinity-related preconstruction work from October 1988 to September 1989. Work included selection of a lateral to be

improved as part of Phase I construction in the GVIC service area, locating individual deliveries and establishing lateral alignments, and rights-of-way activities.

Through a cooperative agreement with Palisade Irrigation District (PID) and Mesa County Irrigation District (MCID), more than \$47,000 was paid from October 1988 to August 1989. Work performed included design data collection for the first phase of construction in the Stubb Ditch Laterals area, negotiations for an operation and maintenance contract, and public involvement activities.

Concern has been expressed over the impacts to wetland and riparian habitats associated with construction and implementation of the salinity control features. The Bureau of Reclamation purchased more than 500 acres of river bottom lands and is seeking transfer of more than 500 acres of adjacent BLM lands to develop a wildlife management area in Grand Valley. A contract providing for the management of wildlife lands along the Colorado River downstream of Fruita was executed between Reclamation and the Colorado Division of Wildlife.

USDA

Implementation continued through the year with both CRSC and Agricultural Conservation Program (ACP) salinity funds. During the year, 57 CRSC contracts were signed with participants, obligating approximately \$1.5 million. Also during the year, 104 long-term agreements were signed with participants, obligating \$360,000 in ACP salinity funds. As of September 30, 1989, a total of 115 CRSC contracts are in effect which obligated over \$3 million. All CRSC and ACP funds were obligated during the year and 19 plans requiring \$610,000 (CRSC funds) have been prepared and are awaiting funding in fiscal year 1990.

Interest in the program among individuals remains strong, with many applications on file.

The installation of salinity reduction practices continues at an accelerated pace. During the year, 31.9 miles of pipeline and concrete-lined ditches were installed. In addition, 439 acres of land were leveled and other salinity reduction practices installed, such as surge and cablegation systems to improve 138 surface irrigation systems. In addition, technical assistance was provided to participants on irrigation water management. The annual salt load reduction achieved to date is 36,360 tons. During the year \$630,000 CRSC and \$710,000 ACP cost-share funds were paid out to participants for the installation of salinity reduction and wildlife practices.

Increased emphasis is being placed on the replacement of wildlife values. In fiscal year 1989, 19 percent of the new participants volunteered to include upland and wetland habitat improvement practices in their contracts. Practices include ponds, fencing, shallow water areas and habitat plantings. To further support the voluntary wildlife habitat program, SCS recently located a wildlife biologist in the Grand Junction field office. This biologist provides full-time assistance on the wildlife habitat replacement program, including coordination with other agencies.

An Extension Agent (Irrigation) is located in the Grand Valley and provides assistance on the CRSC program. During the year, a monthly newsletter (*The Waterline*) was sent to more than 4,000 recipients. A computer spreadsheet for evaluation of surge irrigation systems was developed and slide/tape presentations were prepared for surge and cablegation systems. Field visits were made to assist water users with irrigation water management and to encourage the adoption of salinity reduction practices.

Grand Valley Desert Watershed Activity Plan Demonstration Project, Colorado - BLM

The Grand Valley Desert Watershed Activity Plan has potential both in total salt reduction (approximately 5,000 tons per year) and transferability to similar saline sites in the Colorado River Basin. BLM lands within the Grand Valley are used for livestock grazing, off-road vehicle use, and target shooting. The area also contains a riparian demonstration project. This plan combines ten grazing allotments (approximately 133,000 acres) with the common objectives of increasing vegetative cover in combination with selected land treatments to reduce salt and sediment yields.

In one allotment (Mt. Garfield), a three-pasture rest-rotation grazing system with associated range improvements was implemented in 1971. Monitoring data has shown a 33 to 200 percent increase in ground cover. Key species cover increased from 3 percent to 7 percent. The SCS has estimated that site potential for ground cover is between 15 and 20 percent of total cover.

Sediment yields, determined from reservoir surveys, showed an associated reduction in sediment yields from 0.5 acre-foot per square mile per year to 0.2 acre-foot per square mile per year. Assuming a 3 percent salt content of soil by weight, this grazing management system potentially reduced salt yields by approximately 14 tons per square mile per year. Allotment management plans for the remaining nine allotments need to be revised or rewritten to incorporate the above findings.

Sediment retention structures were constructed in the fall of 1988 to retain sediment and associated salts from off-road vehicle use. The effectiveness of these structures is currently being monitored.

The East Salt Wash Riparian Demonstration Project is located within the Grand Valley Desert Watershed Activity Plan area. Salinity control options associated with riparian improvements are currently being monitored.

Las Vegas Wash Unit, Nevada - Reclamation

The Lower Colorado Region has a continuing monitoring program of the Las Vegas Wash Unit. This activity consists of quarterly collecting and analyzing water samples from selected locations in the Wash. Water quality data will be evaluated and reported annually to permit identification and tracking of any trends in water quality.

Lower Gunnison Basin, Colorado Reclamation

Winter Water.—Under the cooperative agreement with the Uncompahgre Valley Water Users Association, Reclamation has obtained an inventory of the water system needs for the Winter Water portion of the project. One of three water suppliers is expected to be ready for construction in fiscal year 1990. The Appropriations bill for energy and water development (including Reclamation) for fiscal year 1990 includes \$2.5 million for initiating construction activities in the Winter Water portion of the Lower Gunnison Basin Unit.

North Fork area.—In the North Fork area, Reclamation has not found a viable plan and a Preliminary Findings Report concluding the study was published in December 1989.

Uncompahgre Project Retrofit Study.— During fiscal year 1989, an appraisal-level study was conducted to evaluate the concept of allocating the costs associated with extensive improvements to the Uncompahgre Project canal system to the salinity control program, a reimbursable Rehabilitation and Betterment (R&B) program, and the re-use of salvaged water. The study examined the feasibility of lining earth canals and laterals and replacing deteriorated canal and lateral structures. Construction cost estimates were developed based on the Uncompahgre Valley Water Users Association (Association) assuming responsibility for construction performance, management, and administration.

The appraisal report, scheduled for completion in the fall of 1989, will serve as a decision document to indicate whether a planning report/environmental statement should be undertaken. The plans would involve reducing seepage losses by up to 56,000 acre-feet annually which could reduce salt contributions to the Colorado River by up to 114,000 tons per year. The report will demonstrate potential cost allocations and provide an indication of the viability of the concept.

USDA

This was the second year of CRSC cost-share funding for USDA contracts with individuals and groups. During the year 14 CRSC contracts were signed obligating approximately \$510,000. This makes a total of 17 contracts signed since the project started. All CRSC contract funds were obligated during the year and 18 plans requiring over \$800,000 were prepared and are awaiting funding in fiscal year 1990.

During the year 5.1 miles of pipeline and concrete-lined ditch were installed along with other salinity reduction practices such as surge irrigation, gated pipe, and

structures for water control. Technical assistance on irrigation water management was also provided to all participants. The practices installed to date accounted for a salt load reduction of approximately 700 tons per year.

An SCS wildlife biologist is located in the project and devotes full time to assisting with the planning, installation, and tracking of wildlife habitat practices. To date, 31 percent of the salinity control contracts prepared include the voluntary application of wildlife habitat practices. An SCS wildlife biologist position has been established in the Montrose field office to provide assistance on wildlife habitat replacement program in the Lower Gunnison #2 (Montrose County) project area. The biologist has been selected and will be on duty in December 1989.

A full-time Irrigation Extension Agent is located in the Delta USDA Service Center. He provides information, education, and technical assistance for implementation of the salinity control program. During the year, a Lower Gunnison CRSC program brochure was prepared, a sprinkler irrigation workshop was held, and a surge and cablegation field day held. In addition, cablegation and surge irrigation demonstration sites were installed and data collected to verify salt load reduction.

Moapa Valley, Nevada - USDA

SCS began preparation of the Moapa Valley salinity control program draft EIS during the year. It is scheduled for release in 1990. Communications have been established with other agencies and various field data are being collected. The 1989 Nevada Legislature appropriated \$500,000 for program implementation, on the condition of matching funds from both Clarke County and the Muddy Valley Irrigation Company.

This salinity control project, located northeast of Las Vegas, Nevada, is for the installation of onfarm and off-farm irrigation systems and is projected to reduce salt loading to the Colorado River by 19,500 tons per year.

Paradox Valley Unit, Colorado - Reclamation

The facility will be essentially complete this summer and ready for test injection pending the selection and testing of chemical precipitate inhibitors. Samples taken from the primary injection formation, the Leadville Formation, show that without the use of chemical inhibitors, the injection brine will react with water already in the formation to form about 30 tons of solids per day.

Reclamation, through contracts with private consultants, DOE, and USGS geothermal experts, is evaluating the performance of several different mixes of inhibitors. Reclamation is also evaluating the effectiveness of preflooding with fresh water to move the injection interface some distance into the injection formation thus reducing the precipitation potential.

Preparation of supplements to the definite plan report and final environmental statement recommending injection as the brine disposal method was initiated. The documents are being prepared with information now available. The draft documents will be prepared and then put on hold until initial results of the 2-year test are available. Any new information available during the 2-year test will be incorporated into the reports. Final approval of the reports and the Record of Decision is scheduled for September 1991.

Pariette Draw Riparian Demonstration Project, Utah - BLM

The Pariette Draw Riparian Demonstration Project was established in 1986 to restore riparian values, including runoff water quality. Sediment retention plugs (26) were constructed in 1989 with the objective of salinity control.

Price-San Rafael Rivers Unit, Utah - Reclamation/USDA

SCS and Reclamation are preparing a joint plan and EIS for the Price-San Rafael Rivers Unit. Under the joint plan Reclamation will install salinity control features in the irrigation distribution system and USDA will assist individuals and groups apply onfarm salinity reduction practices. At the close of fiscal year 1989 SCS was completing preparation of the USDA onfarm plan and EIS section of the report.

Reclamation will be combining the USDA portion of the report into the draft planning report/environmental statement early in fiscal year 1990. Under the preferred plan, salt loading to the Colorado River system would be reduced by about 162,920 tons per year, with an annual cost of salt removal at \$55 per ton (January 1989 prices).

Sagers Wash Project, Utah - BLM

The Sagers Wash Project was implemented in 1981 and established to determine the effectiveness of controlling erosion through the implementation of structural measures and livestock grazing management changes. The decision made in the Grand Resource Management Plan concerning this project was to conduct detailed monitoring. A comprehensive plan detailing the

effectiveness of this project is scheduled for 1990.

San Juan River Unit, New Mexico

Reclamation

Work has been accelerated on this study because of reprogramming of available funds. Because of the good condition of the Hammond Canal drop structures and cross drainage structures, the lining of the canal system will be less expensive than in other projects. Therefore, the cost-effectiveness should be favorable for most of the canal system—about \$33 per ton (January 1989 prices). Reclamation has completed its plan formulation activities and will prepare a planning report/environmental statement on the Hammond portion of the Unit in fiscal year 1990.

The study was coordinated with USDA to evaluate combined Reclamation/USDA system alternatives. Due to the high percentage of existing sprinkler systems in the project and the expense of piping the delivery system, the combined system did not appear to offer a more cost-effective alternative than the recommended plan. Construction of the recommended plan will be coordinated with USDA to assure delivery system compatibility with the USDA onfarm program.

USDA

SCS initiated preliminary investigations in fiscal year 1989 to explore the potential for an onfarm program in the Hammond Project Irrigated Area. Investigations indicate that an onfarm program appears to be feasible and cost effective. The USDA onfarm planning activities will continue in 1990.

Uinta Basin, Utah

Reclamation

The Reclamation Uinta Basin Unit Planning Report/Final Environmental Statement for Phase I was filed with the Environmental Protection Agency on June 25, 1987, and was being held by the Assistant Secretary's Office. Secretary Lujan's Science Advisor has requested that the report be returned to the Department for processing. The report has been forwarded to the Secretary's office for processing.

Phase II of Reclamation's study in the Uinta Basin is being concluded. The phase II report will recommend that the Myton Townsite Canal be included in the planned improvement for the unit. Lining 3.2 miles of the Myton Townsite Canal is cost effective to remove 2,150 tons of salt annually at a cost of \$90 per ton. The report also recommends evaluating a winter water replacement program alternative in future studies.

USDA

Implementation of the USDA program continued through the year with both CRSC and ACP salinity funds. During the year, 65 CRSC contracts were signed, with participants obligating \$1.64 million. In addition, during the fiscal year 37 long-term agreements and 15 annual agreements were signed, with participants obligating \$438,000 ACP salinity funds. As of September 30, 1989, a total of 186 CRSC contracts have been signed with participants. All funds were obligated during the year and additional plans prepared are awaiting funding in fiscal year 1990. Interest in participation by individuals and groups remains high, with a large number of applications on file awaiting planning and contract funding.

Installation of salinity reduction and voluntary wildlife habitat practices continued at a rapid pace even during this water shortage period. During the year, 83 sprinkler systems and 60 miles of pipeline were installed to reduce deep percolation and seepage from earth ditches. Salinity reduction practices were installed on surface irrigation systems and technical assistance on irrigation water management provided to program participants. The annual salt load reduction achieved since the program was started is 36,414 tons per year. During the year \$1.34 million CRSC and \$1.0 million ACP cost-share funds were paid out to participants for the installation of salinity reduction and wildlife habitat practices.

During the year, program participants installed a variety of wildlife habitat practices including ponds, shallow water areas, wildlife habitat plantings, and fencing. One contract was devoted solely to wildlife practices. For fiscal year 1990, 60 percent of the applications for salinity contracts include wildlife practices and seven applications are solely for the installation of wildlife habitat practices. Wetland and upland habitat management achieved under the salinity control program now totals 4,780 acres.

Monitoring and evaluation activities indicate that the average irrigation efficiency being achieved is 65 percent. In general, the labor required for irrigating with the installed systems decreased and the yields increased when compared to the original systems.

A full-time Cooperative Extension Service Agent provides assistance to the Uinta

Basin CRSC program. During the year, the Cooperative Extension Service completed various information/education activities which included updating the Uinta Basin CRSC video, preparing four new information bulletins, conducting a number of salinity control tours and seminars, and installing several demonstration plots.

Monitoring and Evaluation

Reclamation

Reclamation has a continuing monitoring program of the Las Vegas Wash Unit, Nevada. This consists of quarterly collection and analysis of water samples from selected locations in the Wash. Water quality data will be evaluated and reported annually to permit identification and tracking of any trends in water quality.

USDA

USDA monitoring and evaluation (M&E) plans have been prepared for the USDA Grand Valley, Uinta Basin, Lower Gunnison, McElmo Creek, and Moapa Valley Projects. In the Grand Valley and Uinta Basin, the M&E activities have been underway for over 5 years. Annual reports have been prepared for the Uinta Basin and Grand Valley projects. These reports are providing valuable information as more information is analyzed and techniques are refined. The M&E activities in the other projects are still in the early stages of implementation.

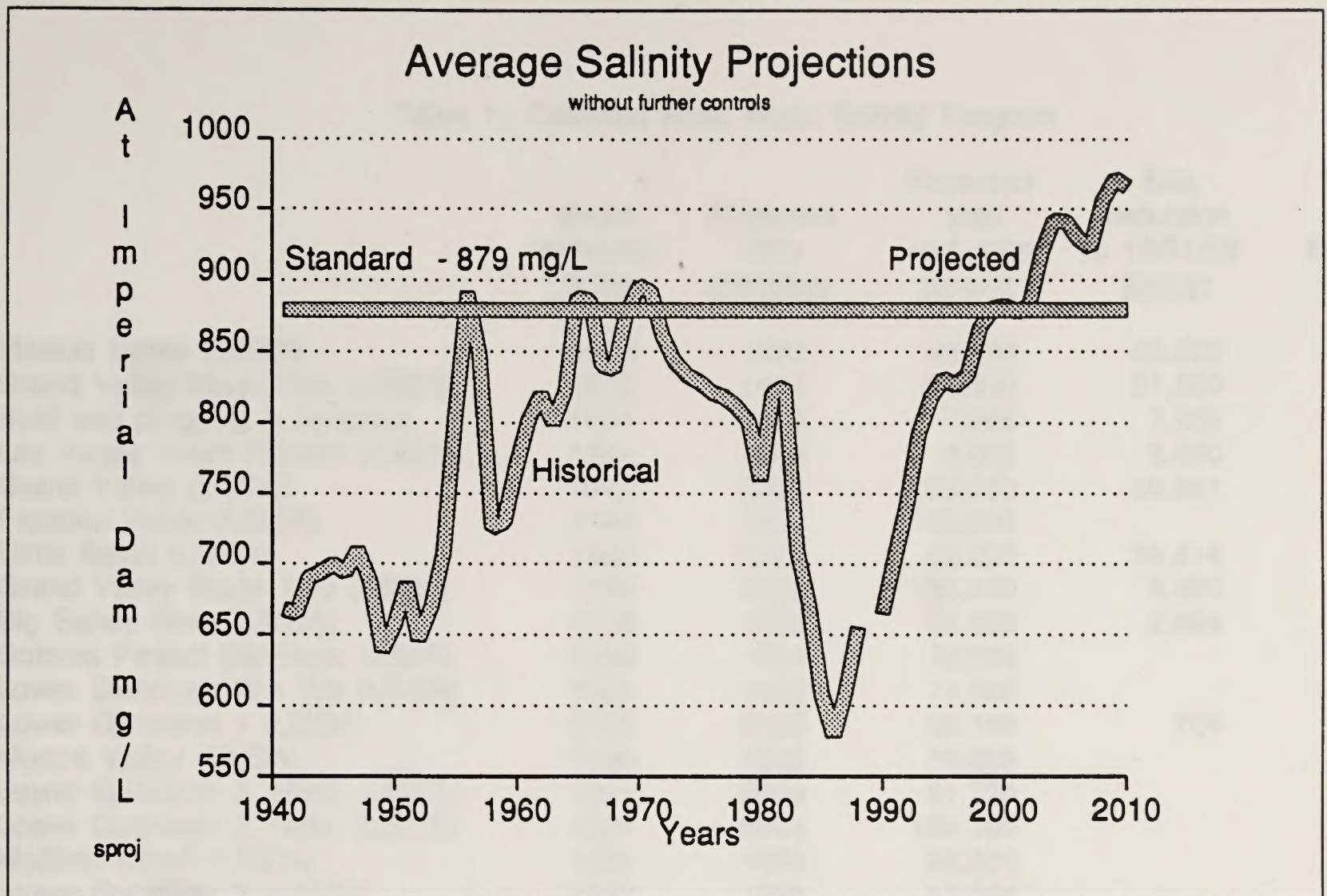


Figure 2.— Average salinity projections at Imperial Dam without further controls.

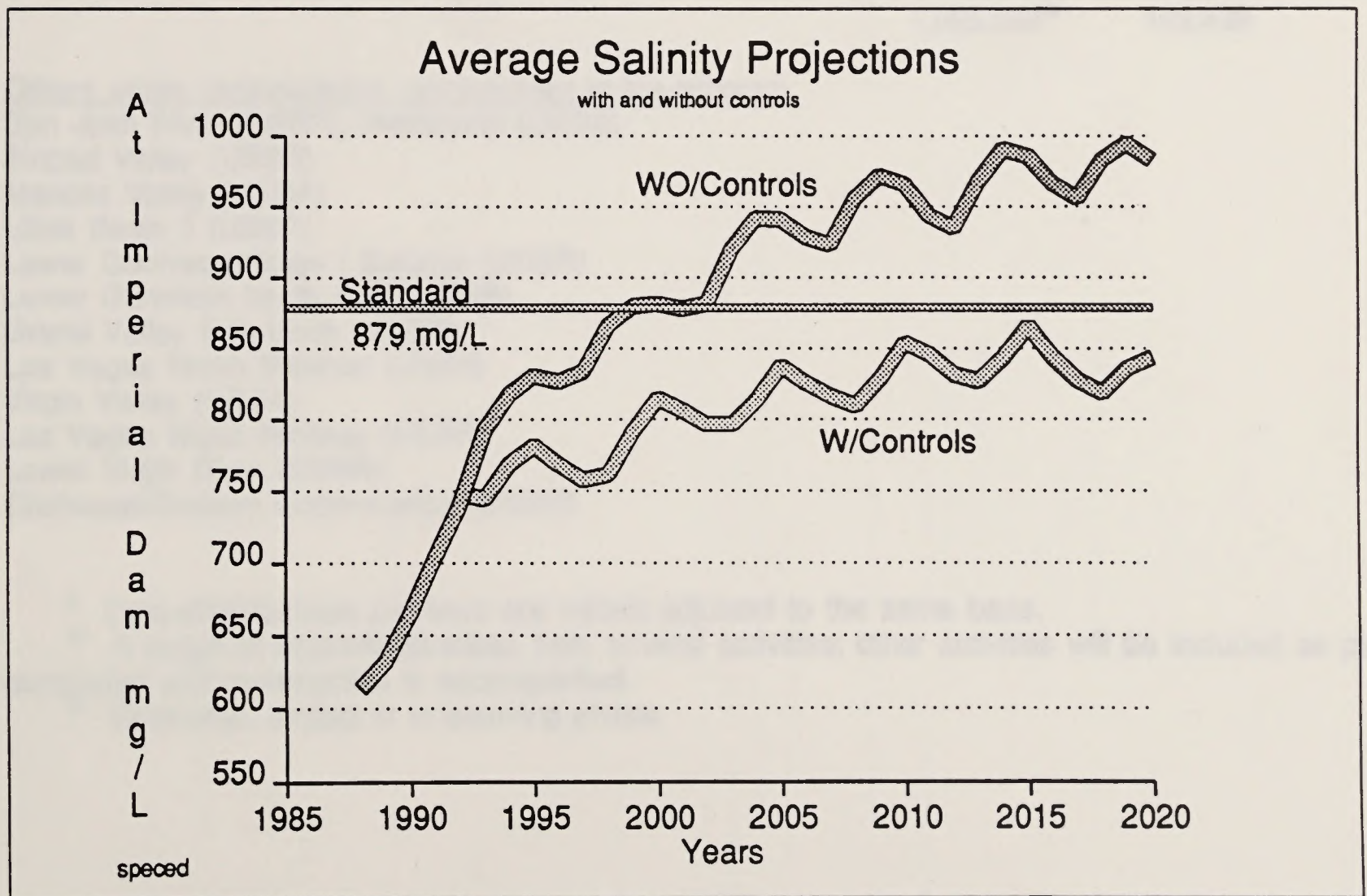


Figure 3.— Average salinity projections at Imperial Dam with and without further controls.

Table 1.--Colorado River Basin Salinity Program

	Begin implemen- tation	Projected date complete	Projected total reduction tons/yr	Salt reduction to 10/31/89 tons/yr	Cost ^{1/} effec- tiveness \$/ton
Meeker Dome (USBR)	1979	1983	48,000	48,000	14
Grand Valley Stage One (USBR)	1980	1984	21,900	21,900	121
BLM well plugging & nonpoint	1984	1988	7,965	7,965	^{2/}
Las Vegas Wash Pittman (USBR)	1984	1985	3,800	3,800	44
Grand Valley (USDA)	1979	2000	163,000	36,361	27
Paradox Valley (USBR)	1980	1990	180,000		49
Uinta Basin (USDA)	1980	2003	98,200	36,414	80
Grand Valley Stage Two (USBR)	1985	2003	106,400	5,600	113
Big Sandy River (USDA)	1988	1996	52,900	2,694	27
Dolores Project (McElmo, USBR)	1989	1994	23,000		84
Lower Gunnison Win Wtr (USBR)	1990	1992	74,000		38
Lower Gunnison 1 (USDA)	1988	2005	82,100	704	64
Moapa Valley (USDA)	1990	1993	19,500		43
Lower Gunnison 2, Mont. (USDA)	1991	2008	81,700		68
Lower Gunnison 2, Delta (USDA)	1991	2004	104,700		41
McElmo Creek (USDA)	1990	1999	38,000		83
Lower Gunnison 3, (USDA)	1992	1995	12,000		74
Uinta Basin I (USBR)	1993	2000	25,500		88
Price-San Rafael (Joint, USBR/USDA)	1993	2008	162,920 ^{3/}		55
			1,305,585 ^{3/}	163,438	

Others under consideration, not included in the program.

San Juan River (USBR), Hammond (USDA)

Sinbad Valley (USBR)

Mancos Valley (USDA)

Uinta Basin II (USBR)

Lower Gunnison Stage I Balance (USBR)

Lower Gunnison North Fork (USBR)

Grand Valley II Balance (USBR)

Las Vegas Wash Balance (USBR)

Virgin Valley (USDA)

Las Vegas Wash Whitney (USBR)

Lower Virgin River (USBR)

Glenwood-Dotsero Cogeneration (USBR)

^{1/} Cost-effectiveness numbers are values adjusted to the same base.^{2/} A range of cost-effectiveness from several activities; other activities will be included as plans are completed and construction is accomplished.^{3/} Estimated, project is in planning phase.



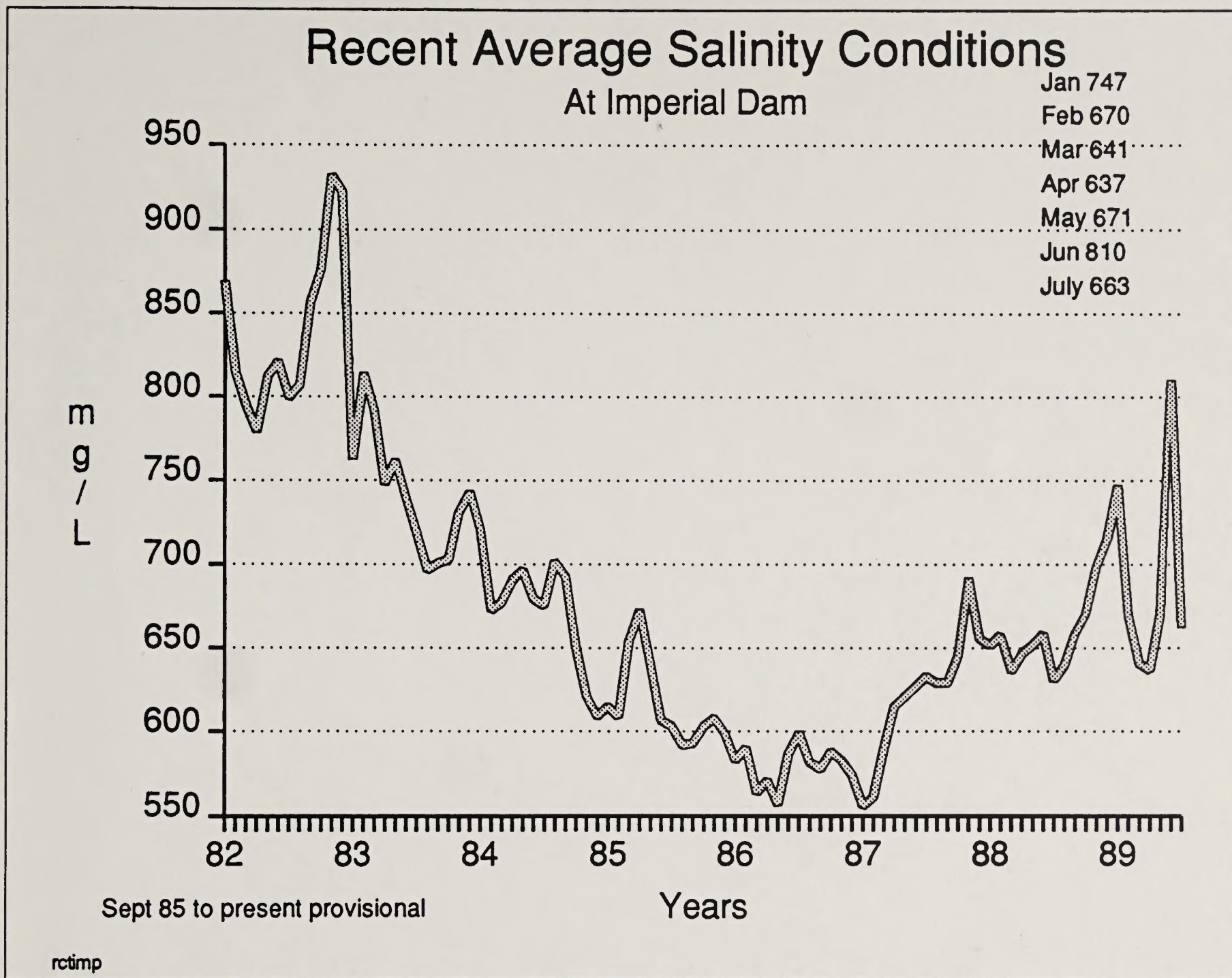


Figure 5.— Recent average salinity levels at Imperial Dam.

